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Home based rehabilitation for patients with COPD. Is it equally effective as compared to outpatient rehabilitation?

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Introduction

Pulmonary rehabilitation programmes are now well established to provide a multidisciplinary approach to control and alleviate symptoms and to optimise functional capacity in patients with chronic obstructive pulmonary disease (COPD). The benefits of pulmonary rehabilitation have been shown in many randomised controlled studies [1-4]. While, most of them were carried out in an inpatient or outpatient setting, the last decade a substantial number of studies have investigated its effects in the home setting. The latter option can be very attractive to patients with severe COPD, as it is more convenient for them and their family, patients can train in their own environment and it might be easier for them to apply their training in daily life. This paper will focus on some aspects of home based rehabilitation and will also compare its effects with outpatient rehabilitation. The following issues will be discussed:

- 1) Which patient should be included?
- 2) How is the organisation of the programme?
- 3) What are the effects?
- 4) Is it equally effective as compared to outpatient rehabilitation?

Which patient should be included?

In 1997 the rehabilitation and Chronic Care Scientific Group of the European Respiratory Society published a position paper on rehabilitation for patients with COPD [5]. According to this paper typical candidates for home based rehabilitation would be: 1) newly diagnosed and first time hospitalised patients, 2) patients with recurrent exacerbations, 3) patients after formal inpatient or outpatient rehabilitation, 4) anxious, confused and forgetful patients 5) end stage terminal patients. They concluded that home based rehabilitation was more a sort of follow-up after inpatient or outpatient rehabilitation. In fact this is correct because rehabilitation in the home setting can not provide the same multidisciplinary treatment as compared

to an in-or outpatient programme. However, the question is whether every patient needs this multidisciplinary approach. Until now literature did not investigate which patient is a suitable candidate for either inpatient rehabilitation or training in the home setting. Most studies that showed positive effects of rehabilitation in the community included patients with a mean forced expiratory volume in one second (FEV₁) between 40% and 60% predicted [6-10]. The study of Wedzicha *et al.* included patients with a lower FEV₁ (mean 37% pred.) and showed that home based rehabilitation in these patients was not effective [11]. However, there are some concerns about the intensity of training in this study. The well-known meta-analysis of respiratory rehabilitation showed that home rehabilitation could be equally effective in improving functional status and quality of life as compared to inpatient rehabilitation [1]. At present we can not conclude that rehabilitation at home for a specific type of patient is less effective. The complexity of medical, psychological and social problems of a patient with COPD determines the staff needed for a rehabilitation programme and thus determines the setting. This means that if the situation is complex and therefore multidisciplinary treatment is necessary, rehabilitation in the home setting is not the preferable setting. However, if a less intensive intervention is needed, patients can be adequately trained both in an outpatient setting and at home.

How is the organisation of the programme?

In fact home based rehabilitation can be set up in two different ways. While initial instruction and supervision takes place in the outpatient clinic of the hospital, the patients train in their own homes. Another possibility is that both training and supervision takes place in the community, where patients do their daily training at home and visit regularly their physical therapist. Because in neither set up the programme takes entirely place in the house of the patient some people prefer to talk about community based rehabilitation instead of

home based rehabilitation. Nevertheless, in all situations an initial evaluation of the patients has to take place in the hospital. This assessment should include lung function and exercise tests. Based upon the outcomes the responsible pulmonary physician should decide if the patient is a good candidate for a programme in the community. The structure of such a programme is not well described. Exercises can be carried out unsupervised [12] or the patients can be supervised by a physical therapist [6, 8, 10, 11]. In some studies the patients were also supervised by a general practitioner or a specialised nurse [8, 10].

What are the effects of home based rehabilitation?

The first study showing benefits of training at home was the study of McGavin *et al.* [12]. They found that 3 months of unsupervised stairclimbing benefitted significantly general well-being and reduced dyspnoea. In addition the 12 minute walking distance (12-MWD) increased significantly in the exercise group in contrast to the control group. In the nineties several other studies showed that home based rehabilitation was effective in improving exercise tolerance [6-8, 10] and Quality of life (QOL) [6, 7, 10], while it reduced dyspnoea [7, 10]. In addition two Dutch studies showed that benefits can even be maintained for up to 18 months, both with [13] and without supervision [8]. In contrast Wedzicha *et al.* did not find benefits of rehabilitation at home in patients with a mean FEV₁ of around 0.9 L and a dyspnoea score of 5 on the Medical Research Council scale (MRC) [11]. No significant changes were found in both shuttle walking distance and quality of life score. However, there is some discussion whether the intensity of training in this group was high enough to achieve benefits. Still, this study raises the question whether patients with severe COPD can be included for training in the home setting. In this respect, an interesting paper was published recently. In the study of Neder *et al.* 15 patients with advanced COPD (mean FEV₁ 39% pred.) were randomised to either a home based 6 week quadriceps femoris neuromuscular electrical stimulation (NMES) training programme (n=9) or to a 6 week control period before receiving NMES (n=6) [14]. Knee extensor strength and endurance, whole body exercise capacity, and health related quality of life were assessed. All patients were able to complete the NMES training programme successfully, even in the presence of exacerbations (n=4). This study showed significant improvements in muscle function, maximal and endurance exercise tolerance, and the dyspnoea domain of the CRDQ ($p < 0.05$) after NMES. They concluded that severely disabled COPD patients with incapacitating dyspnoea, short term electrical stimulation of selected muscles can improve muscle function, exercise tolerance, and breathlessness during activities of daily living. From this study we learn that even for this group of patients a training programme in the community can be effective.

Is home based rehabilitation equally effective as compared to outpatient rehabilitation?

In contrast to the previous section there are only limited studies available that have investigated this question. Currently, there are two studies comparing rehabilitation in the home setting with outpatient setting [8, 15]. Strijbos *et al.* were the first comparing the effects of a 12-week hospital based outpatient rehabilitation programme (HRP) with those of a 12 week home care rehabilitation programme (HCRP) in patients with COPD (mean FEV₁ 1.0 L, 42% pred.) [8]. A control group did not receive rehabilitation. Patients in the HRP group came to the hospital twice a week during 12 consecutive weeks. The sessions of physical therapy (exercise training, breathing and relaxation exercises, bronchial hygiene and education) took 1 hour each. The patients were instructed to practice daily at home for 15 minutes. Patients in the HCRP group received the same programme at home, however, supervised by a local physical therapist. These programmes had a duration 1 hour and were given 24 times (in 12 weeks). The patients were also instructed to practice daily at home for 15 minutes. Besides physical therapy the patients were visited once monthly by a specialised nurse who checked medication and motivated the patients to continue their exercises. After 3 and 6 months the same improvements were detected for maximal exercise capacity (W_{max}), 4 minute walking test, and dyspnoea levels at the same workload (W_{max}). Still after HCRP a further ongoing improvement in W_{max} was observed while it tended to decrease in the HRP group. The authors recommend initiation of home based rehabilitation in patients with COPD as the improvements are maintained longer in this setting.

Puente Maestu recently published a study comparing a high intensity supervised training programme with a self-monitored training programme of low intensity during 8 weeks [15]. Forty one patients with COPD (FEV₁ 41 ± 6% pred.) were randomly assigned either to a supervised training on a treadmill (S group) for 4 days a week or walking exercises on 4 days a week (SM group). The S group trained on a treadmill starting at 3 km/h and a slope leading to an oxygen uptake equivalent of 25% of the difference between maximum oxygen uptake (VO₂ max) and the oxygen uptake at which the lactic acidosis threshold was detected (VO₂ lat). From that point they tried to increase the treadmill distance for 2% for every week. Patients trained 4 days a week for 60 minutes per day under supervision. The SM group was applied with a pedometer and was asked to walk 3 or 4 km in 1 hour a day on level ground for 4 days a week. Due to the design of the study, there was a significant difference in total work performed between both groups, 8001 Kilo-Joules (kJ) and 4237 kJ respectively. After 8 weeks of training a significantly higher VO₂ max was shown in the incremental test in the S group. There was also a significant decrease in lactate accumulation and respiratory rate at the end of the constant exercise test

in the S group. However, no significant effects between both groups were found for QOL, which might be more important for the patient. This suggests that high intensity training is necessary to achieve physiological improvements, while a low intensity self administered programme can achieve this to a lesser degree. Larsson *et al.* [9] showed some years ago that home based training could also lead to physiological training effects. Cycle ergometer training for 4 months in patients with a mean FEV₁ of 50% pred., increased peak oxygen uptake on a graded exercise test and lead to a decrease in heart rate and minute ventilation with no change in oxygen uptake at identical work rates at submaximal levels. In addition, Wijkstra *et al.* showed earlier that home based rehabilitation lead a significant increase in VO₂ max, while there was after 12 weeks of training a significant decrease in lactate accumulation and decrease in the workload of the inspiratory muscles at a significantly higher Wmax [16]. This all means that the setting of rehabilitation setting does not determine whether physiological improvements can be achieved, but the intensity level. When the intensity of training is high enough physiological effects can be achieved in the home setting as well.

In summary, home based rehabilitation is an attractive approach for patients with severe COPD. Low intensity programmes in the community can improve both exercise capacity and quality of life. There is also some evidence that true physiological improvements can be achieved as well if the intensity of training is high enough. For patients with incapacitating dyspnoea neuro electrical muscle stimulation in the home setting seems to be an attractive approach for the future. At this moment there is no evidence that home based rehabilitation is less effective as compared to outpatient rehabilitation. Both settings are probably complementary and either one is preferable depending on the type of patient and available therapy in the community.

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